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Response Capability During Civil Air Carrier Inflight Medical Emergencies

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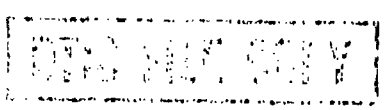

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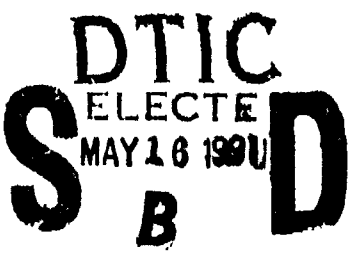

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16. Abstract

Expanded civil aircraft medical emergency kits have been mandated on U.S. carriers since August 1986. Airlines provided the Federal Aviation Agency reports on medical kit usage and outcomes of the associated medical emergencies; 1,016 inflight medical events during the period August 1, 1986, through July 31, 1987, were available for review. Physicians responded to the emergencies in over 63% of the occurrences; the two most prevalent presenting situation were chest pain and syncopal episodes. Nine passengers died on board aircraft, and at least three deaths occurred post-landing. A minimum of 89 of the total cases resulted in flight diversions. The sphygmomanometer (739 cases) and stethoscope (734 cases) were the most frequently used kit items; oropharyngeal airways were utilized in 14 cases. Since standardized reporting formats are not required, evaluation of response capability remains incomplete.

Although an additional year of medical emergency kit usage remains to be reported, mandatory reporting of use to the FAA has not been required since July 1988.

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Foreword

Per Federal Aviation Regulations (FAR) Section 121.715, Inflight Medical Emergency Reports, effective August 1, 1986, each Part 121 air carrier was required to maintain records on each medical emergency occurring during flight time which resulted in the use of the emergency medical kit, diversion of the aircraft, or death of a passenger or crew member.

These records, or a summary thereof, were to be maintained for a period of 24 months commencing with the effective date of the regulation.

The FAA Civil Aeromedical Institute (CAMI) was requested to provide a medical assessment of these reports for the FAA Office of Flight Standards; the attached report represents the analysis for the first twelve month reporting period: August 1, 1986 through July 31, 1987, and is printed in this format with the concurrence of the Aerospace Medical Association, which has published this material as a journal article.

Although the new regulation governing medical kits remains valid, no formal reporting of use has been required past July 31, 1988. The widest dissemination of the attached report is being effected to solicit individual citizen and industry feedback that can contribute to subsequent improvements in onboard medical emergency capability.

Comments about personal or company experience with the use of existent medical kits may be directed to the authors at the address of record on the Technical Information Documentation Page.

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INTRODUCTION

Major revisions in medical emergency kits carried on board commercial air carriers were dictated by regulations promulgated in 1986 (3). To assist the Federal Aviation Administration (FAA) and the airlines in assessing the application of the newly mandated kits (Table I), Federal Aviation Regulations (FAR) Section 121.715, In-flight Medical Emergency Reports, effective August 1, 1986, required each certificate holder (air carrier) to maintain records on each medical emergency occurring during flight time which resulted in the use of the emergency medical kit, diversion of the aircraft, or death of a passenger or crew member.

The FAA requirements for records of medical emergencies call for a description of how the medical kit was used, by whom, and the outcome of the medical emergency. These records, or a summary thereof, were to be maintained for a period of 24 months commencing with the effective date of the regulation, and were to be submitted to the certificate holder's assigned FAA Principal Operations Inspector within 30 d after the end of each 12-month period during the 24-month surveillance period. The FAA's Office of Flight Standards receives the records from Principal Operations Inspectors, and transmits them to the Civil Aeromedical Institute (CAMI). This technical note represents a medical analysis of reports received for the first 12-month reporting period: August 1, 1986 through July 31, 1987.

The methods used to report medical emergencies vary between certificate holders, ranging from concise computer-generated printouts of reported medical emergencies to copies of reports handwritten by a crew member at the time of the emergency. Although 30 certificate holders specifically reported no inflight medical emergencies, reports citing 1,016 occurrences of inflight medical emergencies from 18 carriers were available for review. However, only six carriers provided individual case reports of incidents which reflected details directly from a provider of the medical care. Nonetheless, the lack of a standard medical annotation form, the diversity of medical backgrounds represented in the provider group, the range of penmanship qualities demonstrated, and rare conclusive diagnoses all degraded the potential for medical analysis of the events, even in those cases with more "extensive" data.

Overall Findings

The medical data can be summarized under four broad categories as follows:

a) Of the 1,016 emergencies, 9 involved deaths on board, while 3 (possibly 4) other deaths occurred later at a hospital. All were passenger deaths. There were no reports of crewmember deaths. b) Many of the certificate holders did not acknowledge whether a flight diverted or not after a medical emergency; such reports (299) were treated as "unknown." There were 89 flights documented as diverted and 628 as not diverted. c) Persons using the emergency medical kit are identified in Table II. d) Many of the reports specified the names of the persons who used the medical kit, but not necessarily their titles. Those referred to simply as "Dr." were categorized under "physician." In all probability, many of those included as "unknown" were, in fact, physicians.

Since the reporting requirements permit a wide latitude in content and detail, the data in this study cannot be considered complete, and should not be used for precise statistical analysis or projections. This caution is underlined by the fact that the "unknown" category may reflect either the omission of information in the certificate holder's report, the ambiguity of provided information, or specific acknowledgement that the item was "unknown" to the certificate holder.

Analysis of Deaths

Of the 12 apparent deaths to which references are made in submitted reports, nine probably occurred in the plane, and three off the plane. A 13th case may have been associated with a death, since CPR was administered, but there is no verification of outcome. Of the 12 deaths (plus the one uncertain outcome), 8 appear to be cardiac in nature; the remaining 5 cases include 3 with unknown details, 1 allergy reaction, and 1 with an apparent serious fall (although the reason for this fall could have been cardiac or neurological in origin).

TABLE I. EMERGENCY MEDICAL KIT ITEMS USED INFLIGHT IN 1,016 APPLICATIONS (AUGUST 1986-JULY 1987).

Kit Item*	Reports of Use	Percentage of Total Kit Applications
Sphygmomanometer	739	73
Stethoscope	734	72
Nitroglycerin Tablets (10)	108	11
Syringes (3) (as necessary for administration)	73	7
Needles (6) (as necessary for administration)	72	7
Diphenhydramine (2 ampules)	35	3
Epinephrine (1:1000, 2 ampules)	26	3
Dextrose (50%, 50cc)	22	2
Oropharyngeal Airways (3 sizes)	14	1
Instructions	0	0
Kit Used, but Items Unspecified	55	5

** Designations reflect actual specifications of kit content. For kit items with multiple subelements, the reports of use do not permit a determination of exact numbers or sizes of subelements actually deployed.*

The medical kit, as used in these 13 cases, was obviously not efficacious, except perhaps for the one CPR case in which the outcome is unknown. A physician was present in 8 of the 13 or 62% of the cases, a registered nurse in 1, and the situation is unknown in the remaining 4. The FAA mortality data shares the problems encountered in a recent International Air Transport Association (IATA) review of (1) in-flight deaths; in both studies no formal, systematic process to define the cause of death is available. Further we are hampered because the data contain little medical history.

In comparison, the IATA data represents an 8-year (1977-1984) history of in-flight death-occurrences among 120 IATA members. Forty-two carriers reported such events, with an average of 72 deaths per year, ranging from a low of 57 (1983) to a high of 96 (1977). Although reporting was voluntary, a 26-year history of encouragement of the reporting process by IATA was acknowledged; furthermore, reporting questionnaires were submitted by the medical directors of the reporting carriers. A wide variety of reporting terms was nonetheless introduced; the author grouped related cases according to broad presumptive diagnostic categories with "seemed to be related to cardiac" registered in 56% of deaths. The assisting medical provider was a physician in 43% of the IATA reported deaths.

Categorization of Nonfatal Cases

Categorizing the available data by certain recurring classes of related symptoms, signs, and even specific diagnoses, permits an impression of the magnitude of certain categories of medical problems leading to the use of medical kits. The diverse

symptoms and signs (key words) were generally accommodated in 13 broad functional categories: (A) neurological, (B) pulmonary, (C) cardiovascular, (D) gastrointestinal, (E) obstetrical, (F) renal, (G) endocrinological, (H) traumatic, (I) allergic, (J) motion sickness associated, (K) otolaryngological, (L) nonspecific psychological/physical, (M) unknown. All key words (as identified in the heterogeneous air carrier reports) were arbitrarily assigned to only one of these specific broad medical categories.

The ranking by decreasing prevalence of the key words is presented in Table III. Besides the occurrence count, the category of origin (as defined in the previous listing: A through M) is indicated. General cardiovascular (suspected and real) and syncopal episodes are among the most prevalent presenting problems, consistent with earlier more selective surveys (2,4,5).

Applicability of Available Data to Making Judgments About the Existent MedicalKit

Since much of the available data were available only in summary format or in air carrier-synthesized case reports, this analysis of medical kit effectiveness was necessarily restricted. Nonetheless, the prior review demonstrated the broad categories of encountered problems and their frequencies of occurrence. The 73% and 72% usage rates for the sphygmomanometer and stethoscope were the primary diagnostic applications; the 14 reports (approximately 1% of kit applications) of oropharyngeal airway use represented the most serious (and least frequent) therapeutic applications. However, the recurrent high use of certain items should not be considered evidence of their efficacy. The medical provider may have felt more comfortable having some "tools of the trade," (e.g., stethoscope, sphygmomanometer) with which to monitor the passengers/patients; however, except where the providers may have claimed to reverse a hypoglycemic or an allergic reaction with kit contents, no proof of efficacy (even anecdotal) can be derived from the data as accumulated in these certificate holder reports; even the original diagnosis may be suspect. Efficacy of oropharyngeal airways cannot be precisely defined, since only one available comment about airway equipment quality and utility was formally transmitted, and even in that case final patient outcome was omitted.

TABLE II. PERSONS USING THE EMERGENCY MEDICAL KIT.

User	Number	Percent
Physician	642	63.2
Unknown	273*	26.9
Registered Nurse	61	6
Emergency Medical Technician	21	2
Licensed Practical Nurse	6	0.6
Flight Attendant	4	0.4
Medical Technician	3	0.3
Flight Crew	2	0.2
Physician's Assistant	1	0.1
Military Corpsman	1	0.1
Dentist	1	0.1
Medical Student	1	0.1
All Categories	1016	(100)

** In all probability, a substantial portion of these were also physicians.*

TABLE III. DECREASING PREVALENCE OF CATEGORIZED KEY WORDS.

Count	Category	Key Word
129	L	Pain
123	A	Syncope, Collapsed, Unconscious, Passed Out, Lost Consciousness
95	C	Chest, Chest Pain
62	B	Shortness of Breath, Dyspnea
54	D	Nausea, Vomiting
52	M	Unknown
49	C	Myocardial, Heart, Angina, Ischemic Attack
45	A	Near Syncope, Semiconscious, Faint, Confused
37	A	Seizure, Palsy, Numbness
35	A	Dizziness
33	D	Abdominal
22	B	COPD, Emphysema, Asthma, Pneumothorax
21	L	Hyperventilation, Anxiety, Shaking
21	D	Enteritis, Ulcer, Obstipation, Gastric, Peritonitis, Stomach, Appendix
20	C	Blood Pressure, Hypertension, Hypotension, Vasovagal
18	I	Allergy, Reaction
16	L	Fatigue, Weak, Exhaustion
15	G	Diabetes, Hypoglycemia, Insulin
13	C	Arrhythmia, Bradycardia, Tachycardia
11	A	Drug, Overdose, Alcohol, Inebriation, Poisoning, Tranquilizer
11	H	Injury, Laceration, Wound
9	B	Respiratory, Pulmonary, Breathing, Lung
9	L	Fever
8	H	Nosebleed, Bleeding, Blood
7	J	Motion Sickness, Air Sickness
5	L	Headache, Migraine, Cephalic, Sinusitis, Flu
4	K	Cold, Earache
4	L	Ill
4	F	Kidney, Renal
3	A	Stroke
2	A	Concussion, Oxygen
2	L	Clammy
2	E	Abortion
2	H	Finger
1	D	Esophagus
1	B	Cystic Fibrosis
1	H	Burn
1	H	Eye
1	H	Foot
1	H	Muscle
1	H	Tongue

The appropriate analytical process would demand a detailed standardized identification of the passenger/patient; a checklist driven documentation of history, symptoms and signs; a standardized medical status report on board and one collected from the site of transfer after landing; and specific solicitation of comments from the medical provider addressing improvement of the medical kit. For instance, of the 123 cases with slightly expanded medical documentation available, one can identify at least 5 cases in which the provider noted requests for items absent in the present kit (a larger blood pressure cuff for an obese arm; alcohol wipes; diazepam; atropine; better airway equipment) and even one where an "inoperative" blood pressure cuff was criticized.

The importance of medical history is shown within these same 123 cases by noting that 76 cases (62%) had a pre-existing condition that was associated with the event noted on board the airplane. One could suggest that the choice of medical kit items should be dictated by the known pre-flight medical status of the boarding passengers. These 76 predisposing medical conditions were cardiovascular in 31 cases (41%), gastrointestinal in 8 (11%), diabetic or other endocrinological in 6 (8%), obstetric in 5 (7%), and allergy-associated in 4 (5%). Some of the remaining cases represented passengers with injuries or febrile illness still unresolved at time of flight initiation (9%); pre-existing pulmonary, renal, neurological, psychological, and even intoxication problems were also encountered.

Pre-existing cardiovascular disease is, thus, numerically the largest category in this subset of better defined passenger problems. Within this group were two cases with known pacemakers, and one of these was associated with death as a final outcome of the on board emergency. Unfortunately, the details of this death are not recorded. A cardiologist providing assistance to yet another "cardiac arrest" patient did report inadequate airway equipment, but the medical record does not indicate final status. Several in-flight cardiovascular manifestations proved to be associated with histories of myocardial infarcts, angina, bypass and other surgery, and use of miscellaneous cardiac medications. However, since the majority of these passengers (even if their on board problem was seemingly cardiovascular in origin) did not deteriorate medically on board the aircraft, medical kit efficacy is uncertain. Certainly, the extrapolation of the analysis from these better defined 123 cases to the full set of 1,016 is not appropriate.

Summary

The available data from 1 year of reporting on inflight medical emergencies have revealed that:

1. The five predominant key words groupings (symptoms/signs/diagnoses) in these reports with number of presentations in parentheses, were:
   - Pain (129) (of which various chest pain references made up 95)
   - Syncope, Collapsed, Unconscious, Passed Out, Lost Consciousness (123)
   - Shortness of Breath, Dyspnea (62)
   - Nausea, Vomiting (54)
   - Myocardial, Heart, Angina, Ischemic Attack (49)

   (Note: A passenger might be found within more than one of these presenting key word groupings.)
2. Addressing only a subsample (123 cases) with more extensive documentation provided by the air carrier, 62% of the passengers had a predisposing medical condition related to the onboard problem.
3. Over 63% of the full set of passengers-patients (1,016) were provided assistance by a physician. Of the 12 recorded deaths (plus the one uncertain, but possible death), 9 are specifically recorded as occurring in the aircraft. A physician was present in 8 of these 13 cases, a registered nurse in 1, and the situation is unknown in the remaining 4.
4. Efficacy of kit usage could very rarely be assessed in the heterogeneous patient and provider population.
5. Monitoring of emergency kit usage should be continued, but, more importantly, must be standardized in order to permit systematic evaluation of efficacy and the possibility of content improvement.

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